Date: May 16, 2014

Ms. Annette Feliberty
Commonwealth of Puerto Rico
Office of the Governor
Environmental Quality Board
1375 Ponce de León Avenue
San Juan, PR 00926-2604

Subject: Interim Thermal Mixing Zone Application for Outfall 001 and 002 for the Proposed Aguirre GasPort, Salinas, Puerto Rico

Dear Ms. Feliberty:

As per Rule 1305 Mixing Zones of the Puerto Rico Water Quality Standards (PREQB, 2010), Aguirre Offshore GasPort, LLC (AOGP), a wholly owned subsidiary of Excelerate Energy L.P. (Excelerate Energy) is submitting this application for an interim mixing zone for Outfalls 001 and 002 for the proposed Aguirre Offshore GasPort Project (Project). This application is submitted to address the requirements of Rule 1305, specifically for a mixing zone for thermal compliance with PREQB standards. The application, with technical responses addressing the requirements of Rule 1305, is provided in Attachment I. Exhibits I-VI (referenced in Attachment I) are provided as part of this application package and appended to this application. A CD of this document is also enclosed.

The following Exhibits are referenced and appended in support of this application:

- Exhibit I – Preliminary March 2014 Water Quality Characterization at the Aguirre Offshore GasPort Site (Tetra Tech, 2014) with Comprehensive Laboratory Data Package for Water Quality Analysis (supplied on CD)
- Exhibit II – National Pollutant Discharge Elimination System (NPDES) Permit (no. PR0001660) Aguirre Power Complex
- Exhibit III – Acute and Chronic Definitive Bioassays Using Mysid Shrimp (*Mysidopsis bahia*), Sheepshead Minnow (*Cyprinodon variegatus*) and Sea Urchin (*Arabcia punctulata*) Conducted May 8 –June 12, 2012 (CH2MHILL, 2012);

- Exhibit IV – Aguirre Offshore GasPort Project, Thermal Plume Modeling Assessment - Water Use and Quality (Tetra Tech, 2012);
- Exhibit V - Aguirre Offshore GasPort Project, Addendum to Thermal Plume Modeling Assessment (Tetra Tech, 2014e);
- Exhibit VI - Aguirre Offshore GasPort Project, Work Plan and Quality Assurance Project Plan for Thermal Plume Monitoring.

The details provided in the Attachment I application and Exhibits address the requirements set forth in Section 1305 of the PREQB Water Quality Standards in application for the thermal mixing zone for Outfalls 001 and 002 of the FSRU. We look forward to discussing this application with you at your convenience to facilitate the mixing zone application process. Please contact me via phone (973) 630-8530 or email (John.Schaffer@tetratech.com) with any questions.

Very Truly Yours

Jol D. Schff

John D. Schaffer
Principal Ecologist

Copy with Attachments;
Kate Anderson, USEPA Region II (w/attachments)
Mike Trammel, Excelerate Energy (w/attachments)
Ernest Ladkani, Excelerate Energy (w/attachments)
Craig Wolfgang, Tetra Tech, Inc. (w/attachments)

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Attachment I

Application for an Interim Mixing Zone

For FSRU Outfalls 001 and 002

Aguirre Offshore GasPort, Salinas, Puerto Rico

Application for an Interim Mixing Zone

For FSRU Cooling Water Outfalls 001 and 002

Aguirre Offshore GasPort, Salinas, Puerto Rico

Prepared for:

Excelerate Energy LP
1450 Lake Robbins Drive, Suite 200
The Woodlands, TX 77380

Prepared by:

Tetra Tech, Inc.

1000 The American Road

Morris Plains, New Jersey 07950

Revision 1
May 2014

Table of Contents

1.0 Project and Discharge Descriptions

The Project is to be located in Salinas along the southern shore of the Commonwealth of Puerto Rico, in Commonwealth waters. The Project is being developed in cooperation with the Puerto Rico Electric Power Authority (PREPA) for the purpose of receiving and storing liquefied natural gas (LNG) to be acquired by PREPA, regasifying the LNG, and delivering natural gas to PREPA's existing Aguirre Power Complex (Aguirre Plant). The Project will include an LNG terminal and facilities that will be sited, constructed, and operated pursuant to Section 3 of the Natural Gas Act (NGA), 15 U.S.C. § 717b.

The Project will utilize Excelerate Energy's proven Energy Bridge™ technology to receive, store and vaporize LNG for delivery as natural gas utilizing one of Excelerate Energy's existing Energy Bridge Regasification Vessels (EBRVs) functioning as a floating storage and regasification unit (FSRU). The FSRU will have a storage capacity of approximately 150,900 m^3 of LNG. PREPA will contract for 100% of the available capacity (storage and delivery throughput) from the FSRU. The FSRU will operate in the closed-loop regasification mode[1] and will have the capability of sustained delivery up to approximately 500 MMscf/d of natural gas and peak delivery up to approximately 600 MMscf/d. LNG will be delivered to the Project via LNG carriers (LNGCs), unloaded and stored within an FSRU[2], regasified on the FSRU, and delivered directly to the Aguirre Plant by a subsea pipeline.

The Project will consist of three main components: 1) an offshore berthing platform; 2) an offshore marine LNG receiving facility (Offshore GasPort) consisting of an FSRU moored at the offshore berthing platform; and 3) a subsea pipeline connecting the Offshore GasPort to the Aguirre Plant. The Offshore GasPort will comprise the LNG terminal facilities to be certificated in this application pursuant to Rule 1305 Mixing Zones of the Puerto Rico Water Quality Standards (PREQB, 2010). Outfall 001 is the discharge for the main condenser cooling water for the FSRU. A delta-T of 12 °C above ambient water temperature will be discharged from this port. Outfall 002 is the cooling water discharge for auxiliary systems on board the FSRU. A delta-T of 6.5 °C above ambient water temperature will be discharged from this port. Outfalls 001 and 002 are located on the port side of the FSRU located near the stern of the vessel. These two discharges for which this mixing zone application is submitted are separated by 14 meters (Figure 1). Both discharges are directed away from the Offshore GasPort infrastructure and out into the Caribbean Sea.

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[1] The closed-loop regasification mode does not utilize sea water in the regasification process.

[2] The facility will be designed for long-term, continuous operations. As explained below, the FSRU will be capable of maneuvering on its own away from the offshore berthing platform when necessary and will not be permanently attached to the offshore berthing platform.

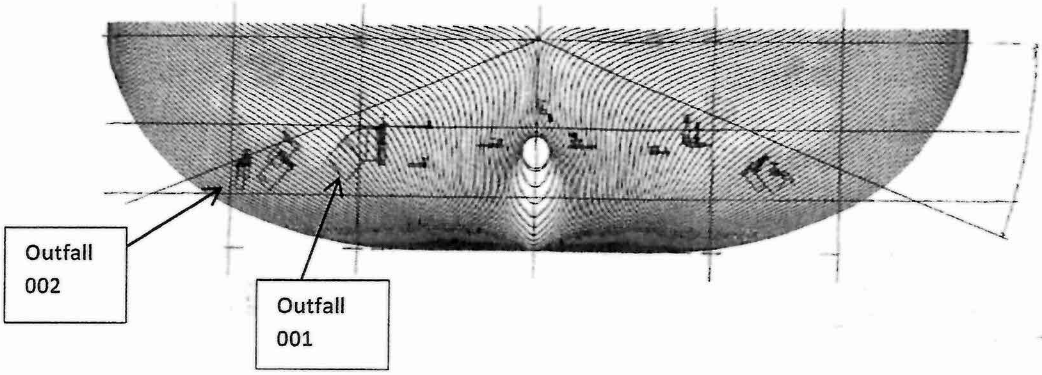

Figure 1. Stern view showing the location of Outfall 001 and 002 on the hull of the FSRU.

2.0 Purpose and Need

The current purpose of the Project is to provide up to 3.2 Bcf of LNG storage capacity and sustained deliverability of 500 MMscf/d, with a peaking deliverability of up to 600 MMscf/d, of natural gas directly to the existing Aguirre Plant. At the time of startup of the facility, the estimated delivery flow rate for the facility will be approximately 255 MMscf/d at 100% load factor generation. PREPA will make daily nominations for the amount of stored LNG to be regasified on the FSRU, to be delivered directly to the Aguirre Plant. The Project will allow PREPA to complete its conversion of the Aguirre Plant from fuel oil only to dual-fuel units capable of burning diesel and natural gas for the combined cycle units and fuel oil and natural gas for the thermoelectric plant.[3]

In response to the Government of Puerto Rico's issuance of a new public policy intended to lower the cost of energy in Puerto Rico by promoting renewable resources and the use of natural gas for power generation, PREPA has developed a plan to lower electricity costs and reduce its carbon footprint. In accordance with this plan, PREPA is aggressively converting a substantial portion of its 4,400 MW of power generation capacity to use natural gas as the primary fuel.

To date, PREPA has converted all or portions of two existing power stations to dual-fuel capability: Units 5 and 6 at the Central San Juan Power Station and the Costa Sur Power Station (Costa Sur Plant) located near Peñuelas, PR. Currently, there is no source of natural gas for the Central San Juan facility and it

[3] The flowing supply that will be required to generate 1,492 MW at the Aguirre Plant will be a function of the turbine, boilers and other equipment designed for the conversion.

continues to burn No. 2 low-sulfur fuel oil. The Costa Sur Plant has completed its conversion project and is currently undergoing testing to burn natural gas being supplied through the EcoElectrica LNG facility.[4]

In order to deliver natural gas to the Aguirre Power Complex, PREPA sought to identify a qualified company to develop, permit, finance, construct, and operate an LNG import terminal off the coast of Aguirre. PREPA would require this facility to provide natural gas to the Aguirre Plant at least 98% of the time. On February 16, 2011 PREPA announced it had selected Excelerate Energy and its proposed Aguirre Offshore GasPort Project as the most qualified company with the preferred solution. This application is necessary for acquiring the water quality certificate from the PREQB in support of the NPDES permit for the Project.

3.0 Interim Mixing Zone Application Documentation

This application is prepared following the requirements for an interim mixing zone, as outlined in Section 1305 of the PREQB Water Quality Regulations. Documentation for the requirements set forth in each individual subsection of Section 1305 is addressed by individual subsection. Exhibits I-VI are appended in support of this application.

Subsection 1305.3(A) and 1305.4(A) Evidence that the project has complied with Article 4(b)(3) of the Law 416 of September 22, 2004, Environmental Public Policy Act, as amended.

Pending completion and submission of the draft federal environmental impact statement (FEIS) and required information for the permitting requirements, the Commonwealth EIS for the Project will be submitted for review and approval.

Subsection 1305.3(B) Physical, chemical, and biological characterization of the discharge and of the receiving waters at the site in which the background concentration is measured, as specified in the most recent version of the Mixing Zone and Bioassay Guidelines approved by the Board. The Characterization shall include the results of toxicity tests using organisms approved by the Board and following the methodology described in said guidelines.

Chemical characterization of the receiving waters of the Caribbean Sea was completed as part of the project specific water quality characterization study performed in March 2014. This water quality characterization study was completed using a work plan and quality assurance project plan (QAPP) approved by the PREQB (Tetra Tech, 2014). Preliminary results of this chemical characterization are detailed in the Water Quality Characterization Technical Memorandum (Tetra Tech, 2014a). The Technical Memorandum and preliminary data are appended as **Exhibit I** to this application. Physical and biological characterization of the Offshore GasPort site was detailed in Resource Report 2 and 3 and their supplemental reports thereafter as part of the Federal Energy Regulatory Commission (FERC) application (Tetra Tech, 2014b, 2014c and 2014d):

- Site Specific Water Quality Characterization Work Plan and Quality Assurance Plan (QAPP) (Tetra Tech, 2014);

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[4] The FERC authorized the EcoElectrica LNG facility by an order issued in May 1996 pursuant to NGA Section 3. See EcoElectrica, L.P., 75 FERC 61,157 (1996).

- Preliminary Water Quality Technical Memorandum (Tetra Tech, 2014a);
- Endangered Species Act (ESA) Coral Mapping and Demography Study (Tetra Tech, 2014b);
- Interim Equivalent Adult Fish Loss Assessment (Tetra Tech, 2014c);
- Potential Coral Larvae Entrainment Analysis (Tetra Tech, 2014d)

As this is a proposed facility, no chemical or toxicological characterizations of the Project discharges are available. However, in lieu of an existing chemical and toxicological profile for the cooling water discharges of the proposed Project, the discharge limitations for the main condenser cooling water discharge Outfall 001a in the National Pollutant Discharge Elimination System (NPDES) permit (NPDES PERMIT PR0001660) for the Aguirre Plant, Salinas, PR are used as estimates for the discharges from Outfalls 001 and 002. The Aguirre Plant NPDES permit is provided in **Exhibit II.** These estimates are for general characterization purposes only, and provide estimates for anticipated characteristics for the discharges from the FSRU.

To characterize the receiving waters for both outfalls, a water quality monitoring effort was performed in March 2014 to provide baseline water quality chemistry at the proposed Offshore GasPort site. This effort was performed consistent with the approved Water Quality Characterization Work Plan and QAPP (Tetra Tech, 2014). A summary report for the field work and preliminary chemical analysis data for this effort are provided in **Exhibit I** of this application. Field parameters (i.e., Horiba water quality readings) for the water column as monitored during the water column sampling effort revealed fairly uniform characteristics throughout the water column with no apparent trend in any reading.

Table 1
Water Quality Chemical Characterization of the Receiving Waters of the Caribbean Sea at the Offshore Gasport Site (Preliminary Data Pending Data Quality Evaluation[1])

Parameter	PREQB Water Quality Standards[4]	BEL-1400860 AOGP WQ 10%	BEL-1400861[5] AOGP WQ 10%	BEL-1400862 AOGP WQ 50%	BEL-1400863 AOGP WQ 90%
Depth (m)		2	2	10	18
Date		3/5/2014	3/5/2014	3/5/2014	3/5/2014
Time		1210	1245	1320	1400
Residual Chlorine (mg/L)	NC	<0.1	<0.1	<0.1	<0.1
Biological Oxygen Demand (BOD_5) (mg/L)	Narrative Criteria	<5.00	<5.00	<5.00	<5.00
Chemical Oxygen Demand (mg/L)	Narrative Criteria	1,580	1,561	1,936	1,064
Dissolved Oxygen (mg/L)	>5.0	8.30	9.30	7.00	7.40
Total Organic Carbon (mg/L)	NC	7.98	7.14	8.82	5.77
Oil and Grease (mg/L)	Narrative Criteria	7.07	5.68	6.52	7.29

Turbidity (NTU)	<10	0.33	0.3	1.45	0.36
MBAS (mg/L)[2]	NC	0.044	0.042	0.067	0.044
Color (Pt-Co)	Narrative Criteria	10 @ 7.65 S.U.	10 @ 7.68 S.U.	5 @ 8.10 S.U.	5 @ 8.11 S.U.
Ammonia-Nitrogen (mg/L)	-	<0.05	<0.05	<0.05	<0.05
Nitrate+Nitrate (mg/L)	-	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (mg/L)	-	<0.20	<0.20	<0.20	<0.20
Total Nitrogen (mg/L)	5.0	<0.10	<0.10	<0.10	<0.10
Cyanide (mg/L)	0.001	<0.005	<0.005	<0.005	<0.005
Sulfide (mg/L)	0.002	<0.05	<0.05	<0.05	<0.05
Antimony (mg/L)	0.64	<0.002	<0.002	0.004	<0.002
Arsenic (mg/L)	0.036	<0.002	<0.002	<0.002	<0.002
Cadmium (mg/L)	0.00885	<0.002	<0.002	<0.002	<0.002
Copper (mg/L)	0.00373	<0.002	<0.002	0.007	<0.002
Lead (mg/L)	0.00852	0.006	0.005	0.003	0.003
Mercury (mg/L)	0.000051	<0.00025	<0.00025	<0.00025	<0.00025
Nickel (mg/L)	0.00828	<0.002	<0.002	<0.002	<0.002
Selenium (mg/L)	0.071	<0.004	<0.004	<0.004	<0.004
Silver (mg/L)	0.00224	<0.002	<0.002	<0.002	<0.002
Thallium (mg/L)	0.00047	<0.002	<0.002	<0.002	<0.002
Zinc (mg/L)	0.08562	0.010	0.009	0.010	0.006
Chromium VI (mg/L)	0.05	<0.009	<0.009	<0.009	<0.009
Total Suspended Solids (mg/L)	Narrative Criteria	<4.00	<4.00	4.00	<4.00
Total Coliforms (CFU/100mL)	<200	130	36	81	36
Fecal Coliforms (CFU/100mL)	<200	<2.0	<2.0	<2.0	<2.0
Conductivity (μmhos/cm)[3]	-	54,000	50,300	53,700	53,600
Salinity (ppt)[3]	-	35.0	34.2	35.0	34.8

Notes:

[1] Data pending quality evaluation and validation

[2] Methylene Blue Active Substances

[3] Analysis added to sample evaluation as per Field Change Request (FCR) 01

[4] PREQB standards for SB/SC classified waters

[5] Duplicate sample of BEL-1400860 AOGP WQ 10%

NC = No PREQB criteria available

Preliminary analytical results of the water quality monitoring effort (Tetra Tech, 2014a) conducted in March 2014 showed a uniform trend in results at the 10, 50 and 90th percent of total depth of the water column in the area of the proposed Offshore GasPort. A single exceedance of PREQB water quality standards was noted for copper in ambient waters in this sampling event at the 50th percent of total depth of the water column (Table 1).

The discharges for both Outfall 001 and 002 of the FSRU are expected to have similar properties with regard to water quality characteristics consistent with non-contact condenser cooling water similar to the Aguirre Plant. The Aguirre Plant NPDES Permit is provided as **Exhibit II** of this application. Table 2 presents the effluent quality standards for Outfall 001a for the main Aguirre Plant cooling water condenser discharge.

Table 2
Aguirre Plant NPDES Permit Limitations and Requirements for Outfall 001 for Temperature and Biofouling Agent (Chlorine) in Condenser Cooling Water

Effluent Characteristics	Monthly Average	Daily Maximum
Temperature (^{o}C)	--	105.98
Total Residual Chlorine[1]	No detectable amount allowed[2]	No detectable amount allowed[2]

Notes:
1) Total residual chlorine (TRC) may not be discharged from any single generating unit for more than two hours per day unless the discharger demonstrates to the permitting authority that discharging for more than two hours is required for macroinvertebrate control.
2) Shall be applicable when chlorine is not used.

Macrofouling control within the FSRU water intake system was thought to use an on-board sodium hypochlorite generator to dose seawater withdrawn through the sea chests with chlorine. However, Excelerate Energy has since determined the vessel assigned to the AOGP project is equipped with a copper-aluminum anode system for macrofouling control in the water intake system. This system will dose water withdrawn through the sea chest intakes with 2.0 parts per billion (ppb) of copper for coating on the internal piping of the non-process cooling water system. This initial dosing of 2.0 ppb of copper remains below the PREQB water quality standard for copper of 3.63 ppb and within the ambient background range of <2 to 6 ppb of copper in the receiving waters based on recent sampling.

For purposes of estimating parameters related to characterizing whole effluent toxicity (WET), the characteristics of Outfall 001 Cooling Water discharge of the Aguirre Plant was identified as being representative of similar process and discharge characteristics as that for the FSRU cooling systems for Outfall 001 and 002. WET testing is comprised of acute and chronic evaluations spanning multiple species and endpoints. Table 3 presents the data for the acute WET testing with mysid shrimp (*Mysidopsis bahia*) and sheepshead minnow (*Cyprinodon variegatus*) from the May 8th –June 12th, 2012 bioassay report (CH2MHILL, 2012) (See **Exhibit III** for the Aguirre Plant bioassay report).

Table 3
Representative Acute Whole Effluent Toxicity (WET) Results for Outfall 001 (001) Cooling Water Discharge for the Puerto Rico Electric Power Authority (PREPA) Aguirre Plant (CH2MHILL, 2012)

Sample ID	Species	Acute LC50	Toxic Unit (TUa)
Outfall 001	Mysid Shrimp, *Mysidopsis bahia*	>100%	<1 TU
Outfall 001	Sheepshead Minnow, *Cyprinodon variegatus*	>100%	<1 TU

Notes:
LC50=Lethal concentration (50%): A point estimate of the test concentration that would cause death in 50 percent of the test population.
TU_a = Toxic Units (Acute): Calculated as 100% sample divided by the LC50 value

Table 4 presents the data for the chronic WET testing with mysid shrimp (*Mysidopsis bahia*), sheepshead minnow (*Cyprinodon variegatus*) and sea urchin (*Arbacia punctulata*) from the May 8th –June 12th, 2012 bioassay report (CH2MHILL, 2012).

Table 4
Representative Chronic Whole Effluent Toxicity (WET) Results for Outfall 001a-d Cooling Water Discharge for the Puerto Rico Electric Power Authority (PREPA) Aguirre Plant (CH2MHILL, 2012)

Sample ID	Species	Chronic LC50	IC25	Toxic Unit (TU_c)
Outfall 001	Mysid Shrimp, *Mysidopsis bahia*	>100%	>100% (Growth) NA (Fecundity)	<1 TU
Outfall 001	Sheepshead Minnow, *Cyprinodon variegatus*	>100%	>100% (Growth)	<1 TU
Outfall 001	Sea Urchin, *Arbacia punctulata*	>100%	>100%	<1 TU

Notes:
LC50=Lethal concentration (50%): A point estimate of the test concentration that would cause death in 50 percent of the test population
IC25=Inhibition concentration 25%
TU_c = Toxic Units (Chronic): Calculated as 100% sample divided by the LC50 value

Subsection 1305.3(C) Existing discharge flow or proposed discharge flow for new or modified discharges:

The estimated discharge flow for the individual proposed FSRU outfalls are provided in Table 5.

Table 5
FSRU Seawater Discharge Volumes (Million Gallons per Day [MGD])

Discharge	FSRU Seawater Discharge (MGD)[1]
Main Condenser Cooling System	47.0
Auxiliary Seawater Cooling System	6.0
Safety Water Curtain	0.6
Ballast Water	±1.9[2]
Freshwater Generator	0.27
Marine Growth Preventative System (MGPS)	0.16
Total	**55.93**

Notes:

[1]Based on standard continuous operation of an Excelerate Energy FSRU

[2]Discharge based upon loading rate and buoyancy compensation needs for the FSRU

These discharge volumes are based on the water balance discussion as presented in Resource Report 2 Water Quality and Quantity (Tetra Tech, 2012) of the Aguirre Offshore GasPort Project FERC application.

Subsection 1305.3(D) Concentration of each one of the substances or parameters that do not comply with the applicable water quality standards at the point of discharge, after using best practicable technology (BPT), as defined by EPA for their control:

The only anticipated parameter to not meet water quality criteria at discharge will be temperature (°C) for the main cooling water (Outfall 001) and auxiliary cooling water condenser (Outfall 002). The anticipated change in temperature will not meet the 32.2 °C (90.0 °F) PREQB standard at the discharge point to the Caribbean Sea.

The estimated change in ambient temperature (delta T) for Outfall 001 is approximately 12 °C (Table 6). The offshore Caribbean Sea is a marine environment with salinities ranging 34 to 36 parts per thousand (ppth) (CREE, 1981). Average water temperatures in Jobos Bay and adjoining offshore waters can range from 25 to 26 °C in the winter to 28 to 29 °C in the summer. At a single historical sampling station, located 1,625 feet southwest of the Aguirre Plant dock towards Mar Negro, water temperatures exhibited a seasonal pattern ranging from 26.2°C in December, to 30.0°C in September (Dieppa, A. et al. 2008). Seasonal temperature monitoring as part of the ichthyoplankton sampling effort at the proposed Offshore GasPort site ranged: 26°C (March), 27.8 °C (May), 29°C (August), 29 °C (November).

Applying an operating rise of 12 °C above ambient temperature, a maximum water temperature upon discharge from the Outfall 001 discharge was estimated to be up to 41.2 °C (Tetra Tech, 2013).

The estimated change in ambient temperature (delta T) for Outfall 002 is approximately 6.5 °C (Table 11). Applying an operating rise of 6.5 °C above ambient temperature, a maximum water temperature upon discharge from the Outfall 002 discharge was estimated to be up to 37 °C (Tetra Tech, 2013).

As the FSRU will remain an operational vessel to be maintained for sea worthiness, the best practical technology (BPT) as applied to marine vessels was deemed achieved for this facility.

Subsection 1305.3(E) Detailed hydraulic design calculations for the proposed discharge system demonstrating that the best engineering practices (BEP) have been used for obtaining the required dilution in the least possible tridimensional space.

The proposed FSRU is an operation vessel with underway capabilities and will be moored to the offshore berthing platform. As an operational seaworthy vessel, underway capabilities will require traditional maritime engineering support systems for both the vessels operation and LNG regasification processes. Due to the confining limits of being an autonomous offshore facility, best engineering practices in the design of the operating systems were used to maintain vessel sea worthiness and LNG transfer and regasification functionality. Detailed design discussions on the FSRU are provided in Resource Report 13 of the FERC Project application.

Subsection 1305.3(F) Description of each mathematical model utilized to determine the critical initial dilution for open coastal waters and dilution for closed water bodies; used to define the mixing zone and the corresponding calculations and/or the field studies where the oceanographic data, measurements of the physical/chemical parameters around the existing discharges and the associated ecological studies demonstrate the extension and effects of the mixing zone.

The dilution models Visual Plumes (USEPA, 2003) and JETLAG were used in an initial non-high rate diffusor (<10 feet per second [fps]) discharge scenario (Tetra Tech, 2012). This original evaluation is provided as **Exhibit IV** to this application. A re-evaluation was performed using a high rate discharge (>10 fps) scenario for the mixing zones based on PREQB (2012) guidance. This re-evaluation is provided as **Exhibit V** of this application.

High Rate Discharge Characterization Addendum (Tetra Tech, 2014 See Exhibit V)

This addendum to the July 6, 2012 Thermal Plume Modeling Assessment (Tetra Tech, 2012) is provided as **Exhibit V** to this application. This addendum documents changes in the dilution characteristics of the thermal discharge from FSRU Outfall 001 and 002 at the Offshore GasPort using the PREQB (2012) Mixing Zone and Bioassay Guidelines for the determination of the point for critical initial dilution (CID). This addendum reflects the application of a high rate discharge (defined as 10 fps) for Outfalls 001 and 002 to meet the PREQB requirements for obtaining a mixing zone permit (PREQB, 2012). Additionally, to mitigate the potential for bottom scour and impacts to benthic communities from this increase in discharge velocity, the discharge ports were re-oriented in the model from a 45 degree downward angle to a 0 degree horizontal angle. This realignment affords greater dissipation potential and eliminates contact of the plume with the sea bottom. The models used in this reassessment were Visual Plumes (USEPA, 2003), an EQB approved model for calculating CID and JETLAG, an EPA approved model for offshore discharges also used in the original thermal plume analysis (Tetra Tech, 2012). The PREQB thermal criterion to be met is 32.2 °C. Both models were run using a minimum current velocity of 0.1 m/sec and no current velocity (0 m/sec) as performed in the original assessment to represent a minimal dilutive gradient.

Outfall 001 Re-Evaluation

Table 6 presents the original (Tetra Tech, 2012) and revised (Tetra Tech, 2014d) discharge parameters applied in the high rate thermal plume discharge assessment for the FSRU. This re-evaluation includes the determination of the point of CID as per PREQB guidance. The depths of the discharge point were varied between 5.3 to 7.4 m to account for buoyancy related effects during cargo and ballast management operations. Tables 7 and 8 show the CID and its horizontal location as well as the diluted plume temperature based on the Visual Plumes and JETLAG models for Outfall 001. The results of the two model reruns are generally consistent with JETLAG predicting larger horizontal distances from the discharge port to the location where the absolute temperature criterion of 32.2 °C is met. US EPA guidance suggests a horizontal mixing zone for 50 times the square root of the discharge port area which in this case is predicted to be 41 m. As shown in Tables 7 and 8, the 32.2 °C temperature criterion is met well within this distance from the discharge.

Table 6
Original and Revised FSRU Effluent Discharge Characteristics for Outfall 001

Vessel Discharge Property	**Original[1] FSRU Discharge 1 Outfall 001**	**Revised [2] FSRU Discharge 1 Outfall 001**
Flow Rate, (cubic meters per second)	2.06	2.06
Discharge Port Diameter, (meters)	1.4	0.92
Port Area, (square meters)	1.54	0.66
Length Scale (square root of area), (meters)	1.24	0.82
Port Discharge Velocity, (meters/se)	1.34	3.10
Discharge Angle from Horizontal, (degrees)	-45	0
Discharge Angle form Ambient Flow, (degrees)	90	90
Discharge Depth Range, (meters)	5.3 – 7.4	5.3 – 7.4
Discharge Temperature Above Ambient (° C)	12	12
Maximum Ambient Temperature, (° C)	29.6	29.6
Water Depth, (meters)	19.2	19.2
Mean Tidal or Ambient Current, (meters/sec)	0.10	0.10
Not to Exceed Temperature Criteria, (° C)	32.2	32.2
EPA Guidance Mixing Zone (50 x length scale), (meters)	62	41

Notes:
[1] As applied in original thermal plume assessment (Tetra Tech, 2012)
[2] As applied in revised thermal plume modeling assessment memorandum using a high rate discharge scenario (Tetra Tech, 2014d)

EPA mixing zone definitions for high velocity discharges are generally more ambiguous and are based on the CID concept. The location of CID defines the mixing zone boundary where water quality criteria (in this case a temperature standard of 32.2 °C) must be met. For buoyant jets this location would be the point at which equilibrium density is reached if the plume remains submerged or where the plume boundary intersects the water surface. For the relatively shallow discharge depth in this situation, CID will occur when the plume boundary intersects the water surface.

The two models give very similar results and indicate that the absolute temperature criterion is met at the CID locations. Tables 9 and 10 summarize the horizontal distance and depth of compliance at which the 32.2 °C temperature criterion is met based on Visual Plumes and JETLAG models. The temperature criterion is met well within the mixing zone defined by the CID for both models.

Table 7
Locations for Critical Initial Dilution for FSRU Outfall 001 Based on the VISUAL PLUMES UM3 Model with Revised Horizontal Discharge at 3.1 m/s

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Critical Initial Dilution (Surface Impact)	Temperature at Critical Initial Dilution (° C)	Horizontal Distance to CID (meters)	Plume Centerline Depth at CID (meters)
1	5.3	0	8.29	31.04	16.39	3.48
2	6.35	0	9.38	30.87	18.70	3.75
3	7.4	0	10.29	30.76	20.56	4.04
4	5.3	0.1	9.71	30.83	13.02	4.16
5	6.35	0.1	11.38	30.65	14.75	4.74
6	7.4	0.1	13.26	30.50	16.51	5.20

Table 8
Locations for Critical Initial Dilution for FSRU Outfall 001 Based on the JETLAG Model with Revised Horizontal Discharge at 3.1 m/s

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Critical Initial Dilution (Surface Impact)	Temperature at Critical Initial Dilution (° C)	Horizontal Distance to CID (meters)	Plume Centerline Depth at CID (meters)
1	5.3	0	7.60	31.18	18.21	3.28
2	6.35	0	8.54	31.01	20.51	3.57
3	7.4	0	9.42	30.87	22.56	3.80
4	5.3	0.1	9.11	30.92	14.78	3.93
5	6.35	0.1	10.61	30.73	16.68	4.44
6	7.4	0.1	12.11	30.59	18.39	4.89

Table 9
Revised Locations at Which Temperature Criterion Are Met for FSRU Outfall 001 Based on the VISUAL PLUMES UM3 Model with Horizontal 3.1 m/s Discharge

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Surface Impact Temperature (° C)	Horizontal Distance to Meet Criteria or to Surface Impact (meters)	Plume Centerline Depth to Meet Criteria or to Plume Boundary or to Surface Impact (meters)
1	5.3	0	32.2	8.20	5.00
2	6.35	0	32.2	8.20	6.05
3	7.4	0	32.2	8.20	7.10
4	5.3	0.1	32.2	6.52	5.12
5	6.35	0.1	32.2	6.52	6.17
6	7.4	0.1	32.2	6.52	7.21

Table 10
Revised Locations at Which Temperature Criterion Are Met for FSRU Outfall 001 Based on the JETLAG Model with Horizontal 3.1 m/s Discharge

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Surface Impact Temperature (° C)	Horizontal Distance to Meet Criteria or to Surface Impact (meters)	Plume Centerline Depth to Meet Criteria or to Plume Boundary or to Surface Impact (meters)
1	5.3	0	32.2	10.27	4.84
2	6.35	0	32.2	10.27	5.89
3	7.4	0	32.2	10.27	6.94
4	5.3	0.1	32.2	7.75	5.05
5	6.35	0.1	32.2	7.75	6.10
6	7.4	0.1	32.2	7.75	7.14

The predicted mixing zone length is 41 meters for Outfall 001 (Table 6). From the Visual Plumes analysis of Outfall 001, the CID is achieved at 20.56 meters (Table 7) and the absolute temperature criterion of 32.2 °C is met at a maximum distance of 8.2 meters (Table 9), both of which are considerably less than the length scale based mixing zone of 41 meters. This suggests that 20.6 meters is a more appropriate length for defining the distance from the hull to the edge of the mixing zone. The technical guidance suggests the mixing zone length be applied in all directions. However, the nature of the discharge exiting perpendicular from the ship hull constrains it to the half plane bounded by the ship hull. The ship hull further constrains the deflection of the plume by the current which will be parallel to the hull. Under these conditions, applying the 20.6-meter length along the hull is unreasonable and inconsistent. The analysis indicates that the maximum horizontal deflection of the plume centerline in the current direction is 2.8 meters at the CID location. Combining this with the plume radius of 5.2 meters suggest a mixing zone length of 8.0 meters in the direction along the hull. Thus a mixing zone extending 16.0 meters along the ship hull, centered at the discharge, and extending 20.6 meters normal to the hull is proposed for the mixing zone boundary.

Outfall 002 Re-Evaluation

Table 11 presents the original (Tetra Tech, 2012) and revised (Tetra Tech, 2014d) discharge parameters applied in the high rate thermal plume discharge assessment for Outfall 002. This re-evaluation included the determination of the point of CID. The depths of the discharge point were varied between 5.3 to 7.4 meters to account for buoyancy related effects during cargo and ballast management operations. Results of the CID assessment for Outfall 002 are presented in Tables 12 (Visual Plumes) and Table 13 (JETLAG). The results of the two models are generally consistent with JETLAG predicting larger horizontal distances from the discharge port to the location where the absolute temperature criterion of 32.2 ^{o}C is met. EPA guidance suggests a horizontal mixing zone for 50 times the square root of the discharge port area, which in this case is 14.6 meters. Tables 14 and 15 indicate that the 32.2 ^{o}C temperature criterion is met well within this distance for both models.

Table 11
Original and Revised FSRU Outfall 002 Discharge Properties

Vessel Discharge Property	Original FSRU Discharge 2 Outfall 002	Revised FSRU Discharge 2 Outfall 002
Flow Rate, (cubic meters per second)	0.26	0.26
Discharge Port Diameter, (meters)	0.4	0.33
Port Area, (square meters)	0.126	0.086
Length Scale (square root of area), (meters)	0.35	0.29
Port Discharge Velocity, (meters/se)	2.06	3.05
Discharge Angle from Horizontal, (degrees)	-45	0
Discharge Angle form Ambient Flow, (degrees)	90	90
Discharge Depth Range, (meters)	6.3 -8.4	6.3 -8.4
Discharge Temperature Above Ambient (^{o} C)	6.5	6.5
Maximum Ambient Temperature, (^{o} C)	29.6	29.6
Water Depth, (meters)	19.2	19.2
Mean Tidal or Ambient Current, (meters/sec)	0.10	0.10
Not to Exceed Temperature Criteria, (^{o} C)	32.2	32.2
EPA Guidance Mixing Zone (50 x length scale), (meters)	17.5	14.6

Tables 12 and 13 present the CID and its location as well as the diluted plume temperature based on the Visual Plumes and JETLAG models. Tables 14 and 15 summarize the horizontal distance and depth where the 32.2 ^{o}C temperature criterion is met as predicted by Visual Plumes and JETLAG. The results indicate that the temperature criterion is met well within the mixing zone defined by the CID in both models.

Table 12
Locations for Critical Initial Dilution for FSRU Outfall 002 Based on the Visual Plumes Model with Revised Horizontal Discharge at 3.05 m/s

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Critical Initial Dilution (Surface Impact)	Temperature at Critical Initial Dilution (CID) (° C)	Horizontal Distance to CID (meters)	Plume Centerline Depth at CID (meters)
1	6.3	0	23.86	29.87	18.10	3.33
2	7.35	0	26.27	29.85	19.77	3.53
3	8.4	0	28.77	29.83	21.40	3.59
4	6.3	0.1	42.87	29.75	12.03	5.19
5	7.35	0.1	52.26	29.72	13.33	5.92
6	8.4	0.1	63.70	27.70	14.81	6.59

Table 13
Locations for Critical Initial Dilution for FSRU Outfall 002 Based on the JETLAG Model with Revised Horizontal Discharge at 3.05 m/s

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Critical Initial Dilution (Surface Impact)	Temperature at Critical Initial Dilution (CID) (° C)	Horizontal Distance to CID (meters)	Plume Centerline Depth at CID (meters)
1	6.3	0	21.84	29.90	20.00	3.12
2	7.35	0	24.19	29.87	21.77	3.28
3	8.4	0	26.49	29.85	23.36	3.40
4	6.3	0.1	40.34	29.76	13.39	5.02
5	7.35	0.1	49.43	29.73	14.70	5.71
6	8.4	0.1	59.11	29.71	16.22	6.34

Table 14

Revised Locations at Which Temperature Criterion Are Met for FSRU Outfall 002 Based on the Visual Plumes Model with Horizontal 3.05 m/s Discharge

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Surface Impact Temperature (° C)	Horizontal Distance to Meet Criteria or to Surface Impact (meters)	Plume Centerline Depth to Meet Criteria or to Plume Boundary or Surface Impact (meters)
1	6.3	0	32.2	1.21	6.30
2	7.35	0	32.2	1.21	7.35
3	8.4	0	32.2	1.21	8.40
4	6.3	0.1	32.2	1.03	6.30
5	7.35	0.1	32.2	1.03	7.35
6	8.4	0.1	32.2	1.03	8.4

Table 15

Revised Locations at Which Temperature Criterion Are Met for FSRU Outfall 002 Based on the JETLAG Model with Horizontal 3.05 m/s Discharge

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Surface Impact Temperature, (° C)	Horizontal Distance to Meet Criteria or to Surface Impact, (meters)	Plume Centerline Depth to Meet Criteria or to Plume Boundary or Surface Impact, (meters)
1	6.3	0	32.2	1.52	6.3
2	7.35	0	32.2	1.52	7.35
3	8.4	0	32.2	1.52	8.4
4	6.3	0.1	32.2	1.25	6.3
5	7.35	0.1	32.2	1.25	7.35
6	8.4	0.1	32.2	1.25	8.4

Mixing Zone Delineation

Outfall 001

The predicted mixing zone length is 41 meters for Outfall 001. From the Visual Plumes analysis of Outfall 001, the CID is achieved at 20.6 meters and the absolute temperature criteria of 32.2 °C is met at 8.2 meters, both of which are considerably less than the length scale based mixing zone of 41 meters. This suggests that 20.6 meters is a more appropriate length. The technical guidance suggests the length be applied in all directions. However, the nature of the discharge exiting perpendicular from the ship hull constrains it to the half plane as bounded by the ship hull. The ship hull further constrains the deflection of the plume by the current which is parallel to the hull. Under these conditions, applying the 20.6 m length along the hull is unreasonable and inconsistent. The analysis indicates that the maximum horizontal deflection of the plume centerline in the current direction is 2.8 meters at the point of CID location. Combining this with the plume radius of 5.2 meters suggest a mixing zone length of 8.0 meters in the direction along the hull. Thus a mixing zone extending 16.0 meters along the ship hull, centered at the discharge, and extending 20.6 meters normal to the hull best describes the dimensions of the Outfall 001 mixing zone.

Outfall 002

The predicted mixing zone length is 14.6 meters for Outfall 002. From the Visual Plumes analysis of Outfall 001, Table 12 indicates that critical initial dilution is achieved at 21.4 meters and Table 14 indicates that the absolute temperature criteria of 32.2 °C is met at 1.21 meters. This suggests that 21.4 meters is an appropriate length. The technical guidance suggests the length be applied in all directions. However the nature of the discharge exiting normal from the ships discharge outlet constrains it to the half plane bounded by the ship's hull. The ship's hull further constrains the deflection of the plume by the current which is parallel to the hull. Under these conditions, applying the 21.4 meter width along the hull is unreasonable and inconsistent. The analysis indicates that the maximum horizontal deflection of the plume centerline in the current direction is 7.9 meters at the CID location. Combining this with the plume radius of 6.6 meters suggest a mixing zone length of 14.5 meter in the direction along the hull. Thus a mixing zone extending 29 meters (width) along the ship hull, centered at the discharge, and extending 21.4 meters perpendicular to the hull best describes the dimensions of the Outfall 002 mixing zone.

Subsection 1305.3(G) Diagram showing the proposed mixing zone and indicating the coordinates of the points that define the boundaries of the mixing zone. and *Subsection 1305.3(H) Proposed method to validate and calibrate (9f necessary) each mathematical model, including a monitoring plan and a Quality Assurance Project Plan (QAPP) that includes field sampling and analysis.*

The mixing zone boundaries were established based on the guidance provided in PREQB (2012), Visual Plumes model results and best professional judgment. The guidance set forth in PREQB (2012) has been established for an extended multi-port discharge diffuser. As the FSRU is a seaworthy vessel that must maintain underway capabilities, the installation of an extended diffuser port off the vessel hull was not possible due to technical application and safety issues. Therefore, application of a common discharge for both Outfall 001 and 002 of the FSRU was assessed using EPA (1991) guidance for a mixing zone definition of a distance equal to 50 times the discharge length scale in all directions. The two outfalls are separated by a distance of 14 meters which would imply an overlay of the separate mixings zones. However it is important to note that both plumes simultaneously deflect with the current so the 8 and 14.5 meter along-hull distances of each plume indicate that there is effectively no overlap. An alternative approach would be to treat the two discharges as a two port diffuser system. In this case, the along-hull mixing zone would be the sum of the separating distance of the deflection plus the radius distance for each port giving 37 meters along the hull centered between the two ports while retaining the larger of the perpendicular from the hull outward distances of 21.4 meters.

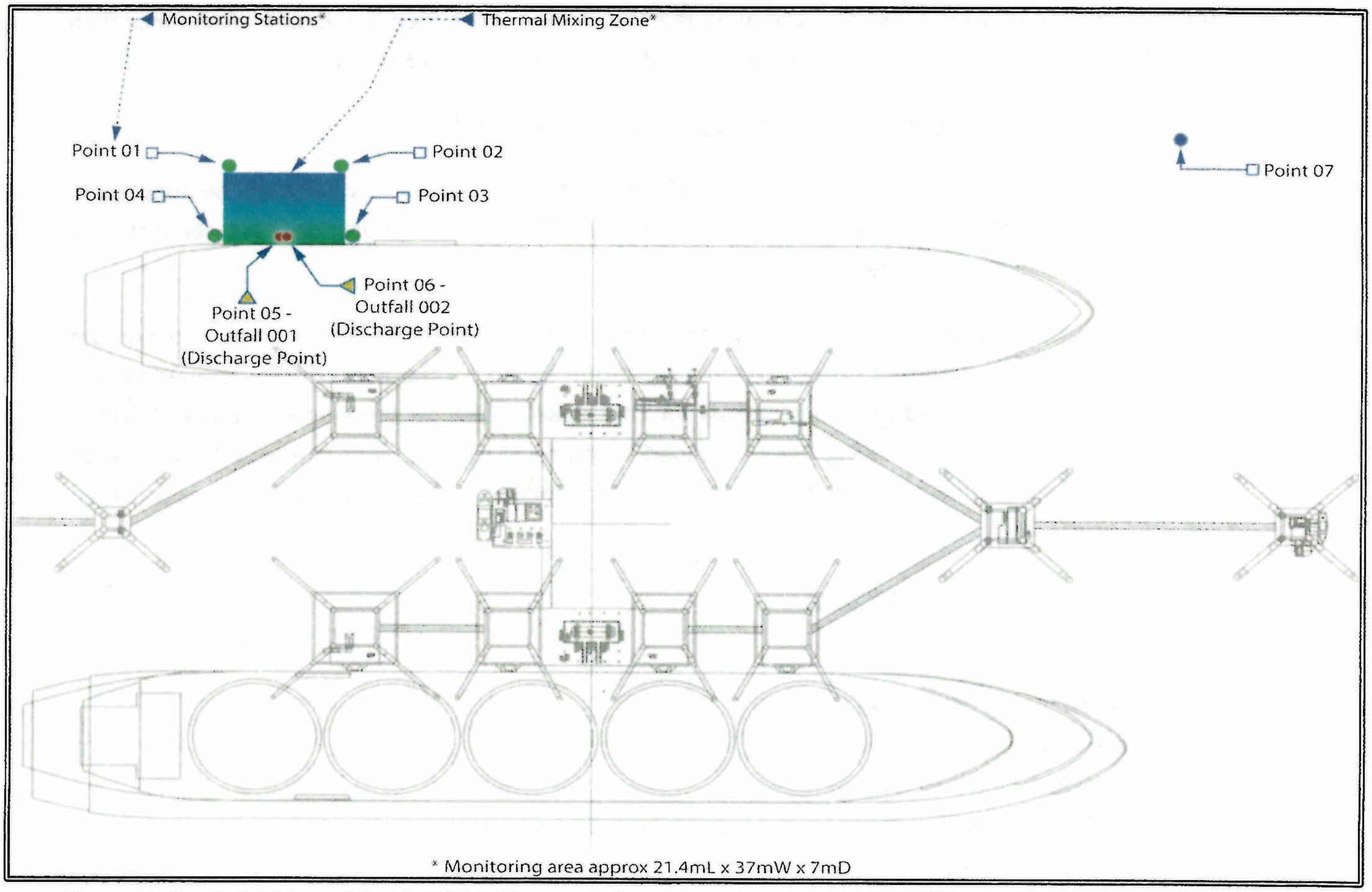

Figure 1 Outfall 001 and Outfall 002 Thermal Plume Monitoring Stations (Figure not to scale)

Table 16 presents the predicted dimensions of the mixing zones for Outfalls 001 and 002 under a minimal current velocity of 0.1 m/sec and that of a combined mixing zone as proposed for the two outfalls. Figure 1 depicts the proposed mixing zone for both thermal discharges.

Table 16
Mixing Zone Dimensions for FSRU Outfalls 001 and 002[1]

Outfall	Mixing Zone Length (meters)	Mixing Zone Width (meters)
001	20.6	16.0
002	21.4	29.0
Combined Port 001/002[2]	21.4	37.0

Notes:
[1] Assumes an ambient current of 0.1 m/sec
[2] Applies a two port diffuser approach for combined cooling water sources

See **Exhibit IV** and Figure 1 of **Exhibit V** to this application for delineation of the proposed mixing zone monitoring points and boundaries. A Thermal Plume Monitoring Work Plan and Quality Assurance Plan for validating and calibrating the thermal plume boundaries is provided as **Exhibit V**.

Subsection 1305.3(l) Proposed method for the maintenance of the discharge system.

An operations and maintenance schedule for the FSRU and Offshore GasPort facilities will be adopted to meet all inclusive safety and operational needs for the FSRU and Offshore GasPort services and functionality to ensure all discharges are maintained.

The Main and Auxiliary Sea Water cooling system onboard the FSRU is designed to have maximum efficiency and to be maintained in proper running condition based on the procedures outlined below. These procedures are approved by Bureau Vertis for this vessel based on the Preventive Maintenance System installed onboard. By following this prescribed schedule of maintenance the vessel will have an efficient operating and stable effluent stream of sea water. The following routine schedule is provided for discussion purposes:

Main Condenser Sea Water Maintenance

- 12 Month (Annual) Basis
  - Vacuum test of condenser
  - Check level device alarm
  - Check vacuum device alarm
  - Check and calibrate system pressure and temperature gauges
- 6 Month (Biannual) Basis
  - Open and clean condenser tubes
  - Check condition of zinc anodes
- 3 Month (Quarterly) Basis
  - Open and clean sea water strainers
- Daily Basis
  - Check back pressure
  - Check / adjust Marine Growth Preventative System (MGPS) system flow meter

Auxiliary Sea Water Cooling System Maintenance

- 6 Month (Biannual) Basis
  - Change over fully welded freshwater heat exchanger
  - Open and clean heat exchanger plates
- Month Basis
  - Clean and check MGPS anode
  - Clean orifice and filters on MGPS
- Daily Basis
  - Check operational temperature and pressure

- Check / adjust MGPS flow meter
- Vent air from top of MGPS flock chamber

Full details exist in the onboard Preventive Maintenance System as well in the following FSRU Technical Operation Manuals:

1. Alfa Laval Plate Heat Exchange Manual M(V) -15
2. Marine Growth Preventing System Manual M(V)-25

Subsection 1305.3(J) Discussion of Agreements reached with the Board on how the applicable provisions of Rule 1305 of this Regulation will be complied with.

Agreements reached with the PREQB regarding this application will be appended to the interim mixing zone application request.

4.0 Section 1305.4 General Standards for Granting Interim Authorizations for Mixing Zones

This application requesting an interim authorization for a mixing zone is being submitted to the PREQB for the Aguirre Offshore GasPort. As this is a proposed project with unique characteristics in setting and engineering, an interim mixing zone application will be submitted for initial approval and further consideration for the final mixing zone application.

Subsection 1305.4(B) The proposed discharge system constitutes the best engineering practices (BEP) to minimize the size and of the tridimensional space of the mixing zone, maintaining the required dilution.

A detailed discussion of the engineering and design of the FSRU and Offshore GasPort are provided in Resource Report 13 of the FERC application. An operations and maintenance schedule for the FSRU and Offshore GasPort facilities will be adopted to meet all inclusive safety and operational needs for the FSRU and Offshore GasPort services and functionality to ensure all discharges are maintained.

Subsection 1305.4(C) Solids in the discharge will not settle on the bottom of the receiving waters

The anticipated water use for the non-process cooling water systems of the FSRU will not contribute any suspended solids to the receiving waters of the Caribbean Sea. Therefore no net suspended solids contributions generated within Outfall 001 or 002 discharges are expected to settle on the bottom within the mixing zone.

Subsection 1305.4(D) At the boundaries of the proposed mixing zone , after critical initial dilution (CID) for open coastal water and after dilution for closed water bodies, each one of the following requirements are met:

1305.4(D)1 The concentration of pollutants or physical parameters, as defined in Rule 1305.5, do not exceed the applicable water quality standards.

Results of the Visual Plumes analysis for Outfalls 001 and 002 indicated that, at the point of CID, water temperatures will meet the PREQB criterion of 32.2 °C well within the projected mixing zone. Table 17 presents the anticipated horizontal distance and water depth at which CID meets the PREQB temperature criterion and the projected extent within the mixing zone.

Table 17
Points of Critical Initial Dilution (CID) for Outfalls 001 and 002 for Thermal Compliance[1]

Outfall	Depth of Discharge (m)	Horizontal Distance to CID (m)	Horizontal Distance to Meet Criteria (m)	Temperature at CID (°C)	PREQB Temperature Criterion (°C)
001	5.3-7.4	16.4-20.6	8.20	30.76-31.04	32.2
002	6.3-8.4	27.7-29.75	1.03	27.7-29.75	32.2

Notes:
[1]Assumes 0 m/sec current influence

1305.4(D)2 The acute toxicity units measure in an acute toxicity test do not exceed the criteria maximum concentration (CMC)

In the absence of a project specific acute toxicity test, test results from the Aguirre Plant for Outfall 001 of that facility are presented as a basis for a similar discharge as Offshore GasPort Outfalls 001 and 002. The CMC will be attained based on estimates from similar discharge from the Aguirre Plant NPDES permit. See Table 3 for a summary of acute test results for Aguirre Plant tests for condenser cooling water discharges.

1305.4(D)3 The chronic toxicity units measure in a chronic toxicity test do not exceed the criteria chronic concentration (CCC)

In the absence of a project specific chronic toxicity test, chronic test results from the Aguirre Plant evaluation for Outfall 001 from that facility are applied as a basis for a similar discharge to the Aguirre Gasport Outfall 001 and 002. See Table 4 for a summary of chronic toxicity test results for Aguirre Plant tests for condenser cooling water discharges.

Section 1305.4(D)4(a) - 1305.4(D)4(c) are not applicable as a high rate discharge (10 feet per sec) is proposed for the mixing zone as per guidance of PREQB.

1305.4(E) The discharge shall not cause the growth or propagation of organisms that negatively disturb the ecological equilibrium in areas adjacent to the mixing zone.

The proposed mixing zone is for temperature dissipation in an open coastal marine environment. The rapid dissipation of the thermal discharge in close proximity to the hull to temperatures will not promote the growth or propagation of organisms that negatively disturb the ecological equilibrium in areas adjacent to the mixing zone. As a requirement of the Interim Thermal Mixing Zone authorization, a monitoring program will be implemented to validate temperature compliance at the edge of the mixing zone. A draft mixing zone monitoring work plan and QAPP is provided in **Exhibit V**. The monitoring plan will be implemented for a one year period for two seasons (winter and summer) as per Subsection 1305.9(B).

1305.4(F) The mixing zone shall be located as to allow, at all times, passageways for the movement or drift of the biota. Also the passageways shall comply with the following in the specific cases mentioned:

The project is located in the Caribbean Sea approximately 3 miles off shore of the Aguirre Plant in Salinas, PR and is approximately 1 mile outside of the Jobos Bay National Estuarine Research Reserve. This location is in the open, marine environment where water depth is approximately 60-65 feet (18-20 meters). The boundaries of the modeled thermal mixing zone for Outfall 001 will approximate 20.6 meters in length and 16 meters in width. The boundaries of the modeled thermal mixing zone for Outfall 002 will approximate 24.4 meters in length and 29 meters in width. The dimension and location of the mixing zone will allow for the movement and drift of aquatic biota around (a deminimis effect on total area of Caribbean Sea) and beneath (an estimated 8-10 meters between the depth of mixing zone to the sea bottom) the influence of proposed mixing zone.

*1305.4(F)1-4*are not applicable to the Offshore GasPort area as the project does not occur in a closed water body, creek, river, or estuary.

1305.4(G) The mixing zone requested will not overlap with an adjacent mixing zone.

No other permitted mixing zone is present in the Project area. Outfall 002 discharges cooling water from the Auxiliary Condenser is located 14 meters to the east of Outfall 001 on the port side of the FSRU. The discharge from Outfall 002 is a 6 MGD discharge or 12% of the discharge associated with Outfall 001. Ambient temperature rise in Outfall 002 is only 6.5 °C and the discharge is predicted to be buoyant. This buoyant plume mixes rapidly in close proximity to the hull of the FSRU where it reaches its CID within 11-13 meters of the discharge point. Under minor current deflection, some degree of overlap may occur between the two plumes depending upon current conditions. To account for this effect, a combined monitoring zone is proposed to monitor compliance of the two thermal plumes within the joint mixing zone boundaries.

1305.4(H) The control technology in accordance with Rule 1306.7, of this Regulation is being used or proposed

The discharges from Outfalls 001 and 002 will be required to meet effluent limits as established under Section 301 of the Clean Water Act as amended, 33 U.S.C. Section 1311, and shall not cause the water quality standards as set forth in Rules 1302 and 1303 to be contravened except as provided under Rule 1304.

1305.4(I) The mixing zone shall be free of debris scum, floating oils and any other substances which produce objectionable odors.

Effluent discharged within the Outfall 001 and 002 mixing zones will be free of debris, floating scum or oil, and substances which produce objectionable odors.

1305.4(J) each mathematical model used by the petitioner to define the mixing zone and inputs of said mathematical model were approved by the Board.

The mixing zone for Outfalls 001 and 002 were determined using guidance set forth in PREQB (2012) and two effluent discharge models: Visual Plumes (USEPA, 2003) and JETLAG. Visual Plumes is a PREQB approved effluent model and was the primary model for the basis of predicting extent of the mixing zone. JETLAG, an older though similar model to Visual Plumes, was also used to verify the relative extent of the mixing zone for Outfall 001 and 002.

1305.4(K) The mixing zone shall not be located in a recognized fish spawning or aquatic organism nursery area or habitat for threatened or endangered species.

Marine surveys of the benthic substrates and communities in the area beneath and surrounding the proposed Gasport Site were conducted in January 2014. These surveys identified the presence of patch coral reefs and fragmented stands of sea grass. Patch coral reef was identified along the southwestern perimeter of the Offshore GasPort site. Occurrence of these patch reefs was isolated to this area. The patch reef community did not occur within the predicted area of the mixing zone for Outfalls 001 and 002. Fragmented stands of sea grass were identified to the northeast and northwest areas beneath the Offshore GasPort site (See Figure 3-1 in Tetra Tech, 2014b). These patches of submerged aquatic vegetation (SAV) were fragmented across the sea bottom with areas of barren coarse sand or scattered fronds of SAV between or around the periphery of these areas. Sea grass and SAV in general are considered essential fish habitat (EFH) for a variety of fish species. However, designation as EFH does not coincide with classification as a recognized fish spawning or as a critical aquatic organism nursery area. The mixing zone of Outfall 002 likewise will occur over the fragmented sea grass meadow and the buoyant nature of the plume will be directed towards the surface of the ocean surface away from the sea floor.

The mixing zones for both outfalls are expected to influence the water column to depths of <7 meters based on achievement of the CID at such depths. Total depth of the water column at the Offshore GasPort site varies between 18 to 20 meters. The mixing zone depth of influence for the lower boundary is estimated to reach to a maximum depth of 6 meters with CID being met at depths of <7 meters below the water surface depending upon current speed. At CID at these depths, the ambient temperature of the water is predicted to be in the range of 30 to 31 °C. No temperature effects on the existing sea grass stands are expected due to the shallow extent of influence of the mixing zone, attainment of PREQB criteria within the mixing zone and the anticipated buffer of 11-13 meters of water column between the lower portion of the mixing zone where the PREQB temperature standard is met and the sea grass present on the sea floor.

1305.4(L) The mixing zone shall not affect in any manner drinking water supply intakes or water intakes for livestock enterprises located less than one hundred meters upstream or 5 kilometers downstream

No non-facility potable drinking water intakes or water intakes for livestock enterprises are affected by the proposed mixing zone boundary.

1305.4(M) Except in the case of cooling waters, the mixing zone limits in coastal waters shall not be located at a distance less than one (1) kilometer from areas designated as public beaches, or classified as SA, and in every water body shall be restricted to avoid interferences with the designated uses of the receiving waters.

The proposed mixing zone is for cooling water compliance with the PREQB water temperature standard of 32.2 °C. The project location is approximately 1 mile off shore from Jobos Bay and is not less than 1 kilometer from a public beach or SA waters. The mixing zone application addresses the need for meeting compliance with the PREQB temperature standard and will meet PREQB standards for other constituents or by meeting the concentrations equivalent to background conditions as established by routine monitoring in support of established by the monitoring program.

The receiving waters of the Caribbean Sea to which these proposed mixing zones are being applied for are classified as SB waters. SB waters are coastal waters and estuarine waters intended for use in primary and secondary contact recreation and for propagation and preservation of desirable, species, including threatened or endangered species. Biological characterizations of the waters surrounding the proposed Offshore GasPort have been performed and are being updated as part of the FERC application process. These studies include the assessment of the Project on coral reefs, sea grass meadows, marine fish, marine mammals and threatened and endangered species. The impact assessments and biological assessments for threatened/endangered species are provided in Resource Report 3 or under separate cover of the FERC application for the Project.

1305.4(N) The proposed methodology to calibrate and validate each mathematical model used is acceptable to the Board.

A mixing zone monitoring plan is provided as **Exhibit V** to this application. The data collected as part of this monitoring plan will be used to calibrate and validate the mixing zone model for both outfalls. The plan provides the proposed methodology to collect the data necessary to calibrate and validate the results of the Visual Plumes model for temperature compliance with the PREQB standard of 32.2 °C. This plan is attached for review and is pending acceptance by the PREQB.

1305.4(O) The proposed method for maintaining in good working conditions the discharge system is acceptable to the Board

The proposed maintenance schedule will follow best management practices (BMPs) and operational requirements and schedule for the steam system of the FSRU as described in Section 1305.3(I) of this application.

1305.4(P) The proposed method for defining the mixing zone boundaries is acceptable to the board and *1305.4(Q) Each proposed mixing zone complies with applicable requirements set forth in Rule 1305 of this regulation*

Pending PREQB review of the revised Thermal Plume Reassessment Memorandum provided as **Exhibit V** to this application and PREQB acceptance of the mixing boundaries there in.

5.0 Calibration and Validation of Mathematical Models (Rule 1305.9)

A Thermal Plume Monitoring Work Plan and QAPP for monitoring the thermal plume boundaries for Outfalls 001 and 002 are provided in **Exhibit V** of this application. This Plan will form the basis for the collection data for supporting the calibration and validation of the Visual Plumes modeling assessment. A Calibration and Validation Work Plan that details the methods and processes for the validation of the model for the mixing zone will be submitted for approval by the PREQB. The monitoring program will be performed for one year in support of the calibration and validation effort. Compliance and validation will be standardized to the standards and conditions set forth in Rule 1305.9(C).

6.0 References Cited:

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USEPA, 1991. Technical Support Document for Water Quality-based Toxics Control. USEPA Office of Water, Washington, DC. EPA/505/2-90-001.